ENERGY $AVER$

"... For Business and Industry".

VOLUME 3 / NUMBER 2

GET AUTOMATIC SAVINGS WITH A SETBACK THERMOSTAT

The Facts...

Energy dollars can literally go "out the window" when heating systems are allowed to run at the same rate at night and on weekends as during normal working hours.

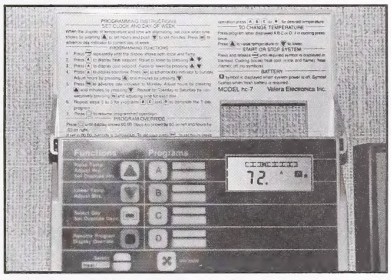
Every building loses heat through its exterior shell (walls, windows, doors and roofs). The rate of heat loss is proportional to the difference between the temperature of the heated air inside and that of the air outside. The greater the temperature difference, the greater the rate of heat loss. Reducing the difference between outside and inside temperatures through temperature setback can help reduce the amount of loss and save on heating costs.

Installing a temperature setback thermostat to reduce temperatures during unoccupied hours is one way to cut energy costs without sacrificing building comfort. This type of thermostat can be set to return the building to normal temperatures prior to workers arriving in the morning.

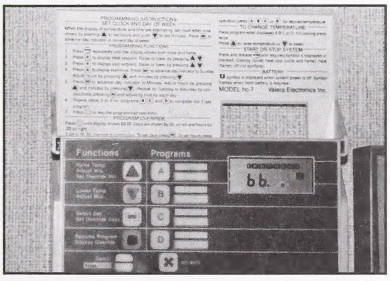
Most buildings are not occupied continuously. For example, offices are occupied 40 to 50 hours a week, or about 25 per cent of the time. Depending on the type of operation, energy cost savings – natural gas and electrical – are possible for a major portion of each 24-hour period.

Generally, for each degree a thermostat is turned down during an eight-hour period, the cost of space heating can be reduced by two per cent. A setback period of at least five hours is needed to show significant savings. For most commercial applications, a setback of 8°C (15°F) is a good rule of thumb, provided the temperature is returned to normal about an hour before the building is to be occupied. In low occupancy areas such as corridors and storage areas, lower temperatures can be continuously maintained.

Some businesses rely on staff to manually set temperatures back after hours and on weekends. While this system can achieve savings, staff can forget to turn the thermostat down before they leave. As well, a building or room may be cool when workers arrive and it may take some time for the air, furniture and equipment to warm up. Temperature setback thermostats automatically reduce the temperature in a specific area and then return it to normal, more reliably than manual adjustment.



Daytime Temperature



Setback Temperature

Setback thermostats can be used in buildings where temperature control is maintained through individual or area thermostats. They are best suited for systems (single or multiple zone) where the annual energy bill is less than $50 000. There are two types of automatic setback thermostats: electromechanical and computerized.

With 24-hour electromechanical controllers, seven-day cycle control is not available. Seven-day cycle control means a thermostat can be set on a time-of-day basis and can be programmed for a different schedule each day of the week. With 24-hour controllers, each day repeats identically unless overridden. This type can allow up to three setback periods a day, varying in length from 30 minutes to 23½ hours.

Computerized controllers have a programmable memory which controls temperatures during specified setback periods. Most programma-

ble thermostats permit at least four different timed temperature settings daily. For some models, different temperatures can be specified for each setback period, and different daily schedules specified for each day of the week.

Depending on the type of setback thermostat installed, the payback period will vary. However, choosing either type of thermostat – electromechanical or computerized – will generally be cost-effective with a payback of less than two years.

The Application...

Staff of the Alberta Energy Bus program have conducted a number of energy audits of facilities owned and operated by the City of Edmonton. Based on energy savings achieved through the audits, Gordon Anderson, Energy Conservation Officer, Parks and Recreation Department, decided that temperature setback thermostats would help to reduce heating and ventilating costs in three offices at city-owned cemetries. Each building has a floor area of about 2000 square feet (190 square metres).

The offices are usually occupied for one shift a day – 8:00 a.m. to 5:00 p.m. The temperature was maintained at 72°F (22°C). After installation of automatic setback thermostats in each office, the temperature was reduced to 60°F (15°C) during unoccupied periods.

According to Deryl Thompson, then City Energy Management Coordinator, installing a setback thermostat at the Mount Pleasant Cemetry in Edmonton has saved the city 15 per cent in natural gas consumption ($176) during 1989. "This sort of saving definitely supports temperature setback during unoccupied periods," Thompson said.

The thermostat was installed in-house at a cost of $140 ($105 for the thermostat and $35 for one hour's labor). Instructions were given to staff on the site as to how the thermostat should be operated. Payback for investing in a setback thermostat was calculated by dividing the installation cost by the savings, in this case, $140/$176 = .8 year or about nine to 10 months.

A computer software package is used to track the energy usage in all city buildings and was useful for determining the actual savings from use of setback themostats.

An additional benefit of automatic temperature setback is that building temperature is back to normal before workers arrive in the morning. Temperatures are automatically setback every night and on weekends, ensuring that savings are reliably achieved.

The Bottom Line...

Potential temperature setback savings will vary among buildings, depending on the number of hours per week the building is used and its annual natural gas cost.

To determine the per cent energy savings from temperature setback, use the graph in Figure 1. You must know the number of hours per day or week that temperatures in your building can be setback and the number of degrees the temperature can be reduced.

To use the graph, first locate the setback hours along the bottom of the graph (hours per day or hours per week) that match your potential setback hours. Read up from the horizontal axis to the appropriate setback line and across to the left to get the per cent energy savings. (The graph is applicable for 22°C indoor temperature and 2°C outdoor, the annual average).

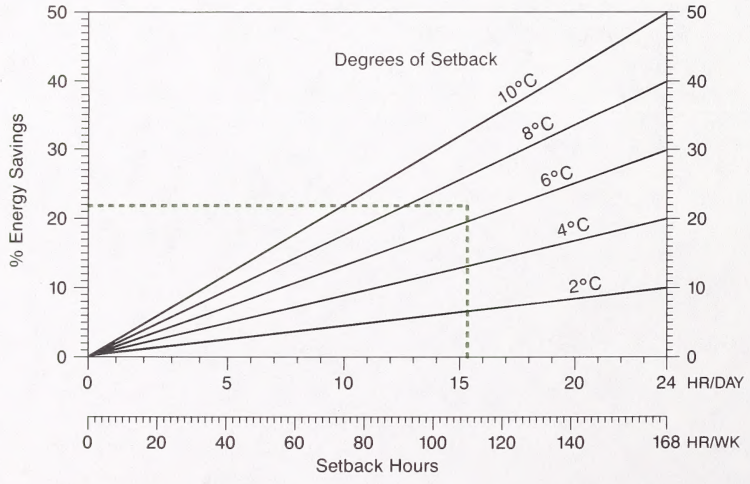
The following example is shown on the graph:

EXAMPLE

Setback hours	14 hours per day All day Sunday = 108 hours per week
Number of degrees of setback	7°C

In this case, the per cent savings would be 22 per cent.

FIGURE 1 **Energy Savings From Temperature Setback**



Graph applicable for 22°C indoor temperature and 2°C outdoor annual average.

Example: Setting back temperature by 7°C for 108 hours per week will save 22% of the space heating cost.

To figure out the payback period for investing in a temperature setback thermostat, divide the cost of implementing the control device by the annual savings, multiplied by 12 months of the year.

For instance, if your building uses $5000 for space heating, and using the example above, the savings from temperature setback would be:

$5000 × .22 = $1100/year

The cost to install five thermostats would be approximately $1000. The payback period is $1000/$1100 × 12 which equals 10.9 months.

These savings do not include the electrical cost savings that result from reduced operation of the heating system fan motor. The payback period will be improved if the electrical savings are included in the calculation.

SECTOR REVIEW

Electric Energy Use in Small Office Buildings...

Energy use varies widely, depending on the type of facility and the activities which take place there. The extent that energy use varies is evident following Energy Bus audits of almost every type of energy-use facility in Alberta.

Initially an energy audit determines how energy is being used and how much it costs in each area. Energy conservation measures which may result in energy cost savings are then identified. On average, the Energy Bus identified potential savings of approximately 20 per cent.

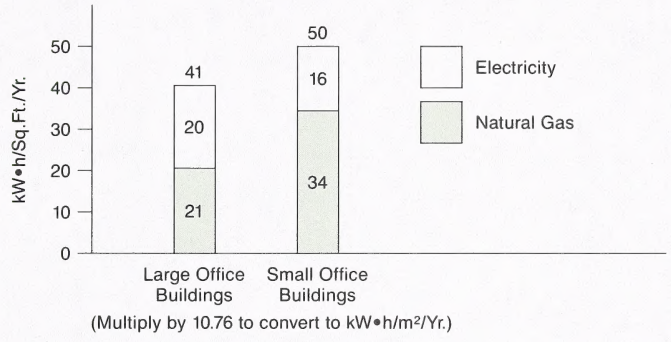
Figure 2, shows total energy use for large and small office buildings. In this analysis, an office building is considered to be large if it has heated or cooled areas totalling 50 000 square feet (4650 m²) or more.

In Alberta, natural gas is the least expensive form of energy. The average price of a unit of electrical energy is 4½ times that of an equivalent unit of natural gas. Therefore, when analyzing energy use, the energy cost must also be considered. Figure 3, compares energy use and cost in small office buildings.

Heating represents 31 per cent of the natural gas used in small office buildings, as shown in Figure 4.

Energy Bus audits have identified considerable potential for reducing heating costs. Lowering the temperature in the office building during unoccupied hours (nights, weekends) will reduce heat loss through the walls and roof. As shown in Figure 5, temperature setback represents 15 per cent of the total natural gas savings identified in small office buildings.

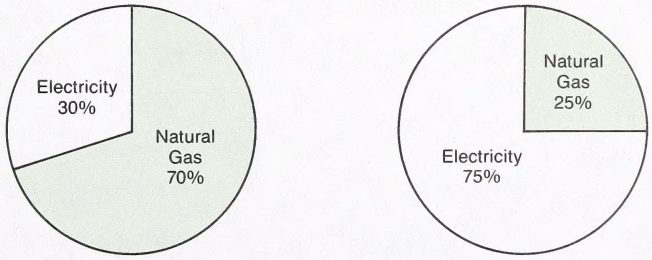
FIGURE 2 **Energy Use – Office Buildings**



(Multiply by 10.76 to convert to kW•h/m²/Yr.)

FIGURE 3

Small Office Building Energy Use and Cost



Energy Use **Energy Cost**

FIGURE 4

Natural Gas Use in Small Office Buildings

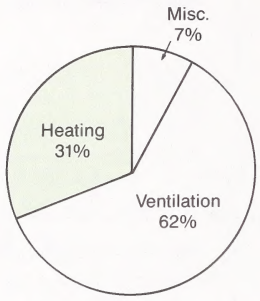
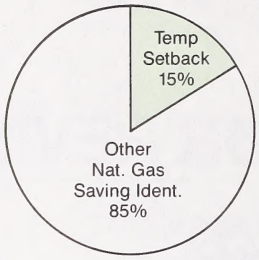


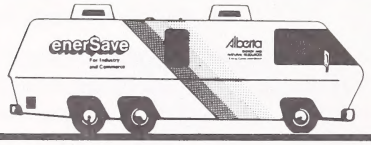
FIGURE 5

Potential Natural Gas Cost Savings



FOR MORE INFORMATION

The article *Get Automatic Savings With A Setback Thermostat* was researched by Jim Riddell, the Sector Review completed by Brian Weir. For detailed information on energy cost-saving calculations and the energy audit database, contact the Technical Services Section of the Energy Efficiency Branch: Phone 427-5200 (collect).



ENERGY $AVER$

Energy $aver$ is a series of fact sheets about energy efficiency measures that have wide application in Alberta. Each issue highlights a different technology and its successful use in the province. The Sector Review summarizes energy use patterns of different facilities that have used Alberta's Energy Bus audit service. Comments, questions, and suggestions are welcome.

Write or phone (collect) to be placed on the mailing list. You may also receive back issues or arrange for an Energy Bus audit (conducted at no charge).

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